

**BRITISH STANDARD****BS EN  
1135:1995****Method for****Determination of ash  
of fruit and vegetable  
juices**

The European Standard EN 1135:1994 has the status of a  
British Standard

UDC 665.81/82.890.1:648.822

Application No. 10/524,014  
Exhibit No. 5

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BS EN 1185:1995

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This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Board, was published under the authority of the Standards Board and comes into effect on 15 January 1995

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The following BSI references relate to the work on this standard:  
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Amnd. No.	Date	Comments

## Contents

	Page
Cooperating organizations	Inside front cover
National foreword	ii
Foreword	2
1 Scope	3
2 Normative references	3
3 Definition	3
4 Principle	3
5 Reagents	3
6 Apparatus	3
7 Procedure	3
8 Calculation	3
9 Precision	4
10 Test report	4
Annex A (informative) Bibliography	5
Annex B (informative) Statistical results of the inter-laboratory test	5
National annex NA (informative) Committees responsible	Inside back cover
National annex NB (informative) Cross-references	Inside back cover
Table B.1	5

BS EN 1135:1995

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## National foreword

This British Standard has been prepared under the direction of the Consumer Products and Services Sector Board and is the English Language version of EN 1135:1994 *Fruit and vegetable juices — Determination of ash*, published by the European Committee for Standardization (CEN). EN 1135 was produced as a result of international discussions in which the United Kingdom took an active part.

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright data) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 1135

October 1994

UDC 663.817.82:630.1:643.832

Descriptor: Food products, beverages, fruit and vegetable juices, chemical analysis, determination of content, ashes

English version

Fruit and vegetable juices — Determination of ash

Jus de fruits et de légumes —  
Détermination de cendres

Frucht- und Gemüsesäfte —  
Bestimmung des Asche

This European Standard was approved by CEN on 1994-09-29. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

**EN 1135:1994**

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**Foreword**

This European Standard was prepared by the Technical Committee CEN/TC 174, Fruit and vegetable juices — Methods of analysis, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by April 1996, and conflicting national standards shall be withdrawn at the latest by April 1996.

Annexes designated "informative" are given only for information. In this standard Annex A and Annex B are informative.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## 1 Scope

This European Standard specifies a method for the determination of ash of fruit and vegetable juices and related products.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 6725:1986, *Precision of test methods—Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests*.  
ISO 3696:1987, *Water for analytical laboratory use—Specification and test methods*.

## 3 Definition

For the purposes of this standard, the following definition applies:

### ash content

the residue of a fruit or vegetable juice or related product obtained when the organic constituents and water are completely removed by calcination, expressed in g/l

## 4 Principle

The ash is determined gravimetrically after calcination of the test sample in a muffle furnace at  $525^{\circ}\text{C} \pm 25^{\circ}\text{C}$ .

## 5 Reagents

Use only water in accordance with at least grade 2 of ISO 3696.

## 6 Apparatus

Usual laboratory apparatus and, in particular, the following:

6.1 *Platinum dish*, approximate diameter 80 mm, with flat bottom.

6.2 *Water bath*

6.3 *Muffle furnace*, capable of maintaining a temperature of  $525^{\circ}\text{C} \pm 25^{\circ}\text{C}$ .

6.4 *Desiccator*

6.5 *Analytical balance*, accurate to 0,1 mg.

## 7 Procedure

### 7.1 Preparation of the test sample

Normally products shall not be pretreated and their analysis by this method shall be on a volumetric basis, results being expressed per litre of sample. The analysis of concentrated products may also be carried out on a volumetric basis, after dilution to a known relative density. In this case, the relative density shall be indicated. Based on a weighed sample and taking the dilution factor for analysis into account, the results may also be expressed per kilogram of product. In products with high viscosity and/or very high content of cells (for example pulp), determination on the basis of a weighed test sample is the usual procedure.

### 7.2 Test procedure

Evaporate 25 ml (or 25 g; see 7.1) of test sample to dryness in the previously weighed platinum dish (mass  $m_1$ ; 6.1), using the water bath (6.2). Other suitable means of evaporating the water contained in the test sample may be used, providing they do not lead to loss of inorganic constituents.

In a fume cupboard slowly heat the dry residue on a hot plate until the greater part of the organic constituents has burned away. Calcine in the muffle furnace (6.3) at a temperature of  $525^{\circ}\text{C} \pm 25^{\circ}\text{C}$  until the organic constituents are completely removed and the residue is white. The temperature of the furnace shall be monitored using a suitable measuring device. Allow the platinum dish with the residue to cool to ambient temperature in the desiccator (6.4) and weigh immediately (mass  $m_2$ ).

Sometimes the organic constituents do not burn away completely. In such cases, moisten the ash with water and repeat the evaporation and calcination steps. If necessary, repeat this procedure several times.

## 8 Calculation

Calculate the ash of the test sample in grams per litre as follows.

$$\text{Ash} = 40 \times (m_2 - m_1)$$

where:

40 is the conversion factor from 25 ml

to 1 000 ml (or 25 g to 1 kg, see clause 7.1);

$m_1$  is the mass of the platinum dish with ash, in grams;

$m_2$  is the mass of the empty platinum dish, in grams.

EN 1135:1994

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Take into account the dilution factor and the relation of the value of the mass or volume. If a concentrated product has been diluted to single strength, report the relative density of the single strength sample.

Express the ash in grams per litre to two decimal places.

## 9 Precision

Details of the interlaboratory test on the precision of the method are summarized in Annex B. The values derived from the interlaboratory test may not be applicable to analyte concentration ranges and matrices other than given in Annex B.

### 9.1 Repeatability

The absolute difference between two single test results found on identical test material by one operator using the same apparatus within the shortest feasible time interval will exceed the repeatability value  $r$  in not more than 5 % of the cases.

The values are:

$$\rho \leq 4 \text{ g/l: } r = 0,09 \text{ g/l}$$

$$\rho > 4 \text{ g/l: } r = 0,14 \text{ g/l}$$

where:

$\rho$  is the measured ash, calculated as mean value from the two single test results.

### 9.2 Reproducibility

The absolute difference between two single test results on identical test material reported by two laboratories will exceed the reproducibility value  $R$  in not more than 5 % of the cases.

The values are:

$$\rho \leq 4 \text{ g/l: } R = 0,13 \text{ g/l}$$

$$\rho > 4 \text{ g/l: } R = 0,29 \text{ g/l}$$

where:

$\rho$  is the measured ash, calculated as mean value from the two single test results.

## 10 Test report

The test report shall contain the following data:

- all information necessary for the identification of the sample (kind of sample, origin of sample, designation);
- a reference to this European Standard;
- the date and type of sampling procedure (if possible);
- the date of receipt;
- the date of test;
- the test results and units in which they have been expressed;
- whether the repeatability has been verified;
- any particular points observed in the course of the test;
- any operations not specified in the method or regarded as optional, which might have affected the results.



EN 1135:1994

## Annex A (informative)

### Bibliography

#### [1] Determination of ash: No 9, 1989.

— In: *Analyses [Collection]* / *International Federation of Fruit Juice Producers*

— Loose-leaf edition, as of 1989. — Zug: Swiss Fruit Union.

Untersuchung von Lebensmitteln: Bestimmung der Asche in Fruchtsäften: L 31.00-4, 1980-05 [Food Analysis: Determination of ash content: L 31.00-4, 1980-05] — In *Ämtliche Sammlung von Untersuchungsverfahren nach §35 LMBG: Verfahren zur probenahme und Untersuchung von Lebensmitteln* / *Tabakerzeugnissen, kosmetischen Mitteln und Bedarfsgegenständen, Bundesgesundheitsamt* [In: *Collection of Methods of sampling and analysis of foods, tobacco products, cosmetics and commodity goods/Federal Health office*] — Loseblattaussgabe, Stand 31.12.1991, Bd 1 [Loose-leaf edition, as of 1991-12-31, Vol 1] — Berlin, Köln: Beuth Verlag GmbH.

## Annex B (informative)

### Statistical results of the interlaboratory test

In accordance with ISO 5725:1986, the following parameters have been defined in an interlaboratory test. (For literature pertaining to the method see Annex A). The test was conducted by the Max von Pettenkofer-Institute of the Federal Health Office, Food Chemistry Department, Berlin, BRD:

Year of interlaboratory test 1977

number of laboratories 14

number of samples 4

Table B.1

Sample	A	B	C	D
Number of laboratories retained after eliminating outliers	11	11	10	12
Number of outliers (Laboratories)	3	3	4	2
Number of accepted results	58	56	54	63
Mean value ( $\bar{x}$ ) (g/l)	1,96	2,37	3,42	4,82
Repeatability standard deviation ( $s_r$ ) (g/l)	0,0253	0,0349	0,0316	0,0508
Repeatability relative standard deviation (RSD <sub>r</sub> ) [%]	1,29	1,47	0,92	1,05
Repeatability limit ( $r$ ) (g/l)	0,07	0,10	0,09	0,14
Reproducibility standard deviation ( $s_R$ ) (g/l)	0,0437	0,0475	0,0536	0,1036
Reproducibility relative standard deviation (RSD <sub>R</sub> ) [%]	2,23	2,00	1,57	2,15
Reproducibility limit ( $R$ ) (g/l)	0,12	0,13	0,15	0,29
NOTE: Orange juice shows higher values for $r$ and $R$ , perhaps because of content and/or matrix effects.				

Sample types:

A black current nectar

B apple juice

C grape juice, white

D orange juice

**National annex NA (informative)**  
**Committees responsible**

The United Kingdom participation in the preparation of this European Standard was entrusted by the Consumer Products and Services Sector Board to Technical Committee AW/21 upon which the following bodies were represented:

British Food Manufacturing Industries Research Association  
British Fruit Juice Importers' Association  
British Retail Consortium  
British Soft Drink Association Limited  
Campden Food and Drink Research Association  
Department of Trade and Industry (Laboratory of the Government Chemist)  
Ministry of Agriculture, Fisheries and Food  
Royal Society of Chemistry

**National annex NB (informative)**  
**Cross-references**

Publication referred to	Corresponding British Standard
ISO 8696:1987	BS 3978:1987 <i>Specification for water for laboratory use</i>
ISO 5725:1986	BS 5497 <i>Precision of test methods</i> Part 1:1987 <i>Guide for the determination of repeatability and reproducibility for a standard test method by inter-laboratory tests</i>

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**OFFICIAL  
METHODS OF ANALYSIS  
OF THE  
ASSOCIATION OF OFFICIAL  
ANALYTICAL CHEMISTS**

EDITED BY SIDNEY WILLIAMS

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FOURTEENTH EDITION, 1984

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ARLINGTON, VIRGINIA 22209 USA

Application No. 10/524,014  
Exhibit No. 6

## 810 VEGETABLE PRODUCTS, PROCESSED

## AOAC OFFICIAL METHODS OF ANALYSIS (1984)

## Specific Gravity of Canned Vegetables

## Final Action

32.026

## Specific Gravity

(Applicable to comminuted tomato products)

Det. sp gr at 20.0°, using Gay-Lussac or similar small-neck bottle without top. Clean and calibrate bottle at 20° as in 9.018, strike off excess  $H_2O$  with straight edge, wipe bottle dry, and weigh immediately. Cool sample to 16–18°, fill bottle with the pulp, and centrif. 1 min at ca 1000 rpm. Add enough pulp to fill bottle to top and centrif. again. Remove bottle and take temp. of pulp, inserting thermometer so that no air is introduced. When temp. is just 20°, remove thermometer, add enough pulp at same temp. to have bottle slightly over full, and strike off even with straight edge. Clean outside of bottle and weigh at once to nearest 0.01 g.

Sp gr = wt pulp in bottle ÷  $H_2O$  at 20° that bottle holds.

Refs.: N.C.A. Bull. 37-L, Revised 1966, p. 26. JAOAC 19, 254 (1936).

## Ash of Canned Vegetables

32.027

## Ash

See 31.012 or 31.013.

32.028

## Alkalinity of Ash

Proceed as in 32.028. Express result as mL 1N acid required to neutralize ash from 100 g sample.

## Calcium in Canned Vegetables

## Titrimetric Method

## Final Action

(Applicable to canned lima beans, potatoes, and tomatoes)

32.029

## Reagents and Apparatus

See 36.050 and 36.051.

32.030

## Preparation of Sample

This thoroughly comminute entire contents of can (representative portion if larger than No. 303 size can) in high-speed blender. Weigh 50 g sample (100 g in absence of declaration of added Ca) into Pt or porcelain dish. Evap. to dryness, using forced-draft oven, or radiation, or other convenient means. Ash and treat as in 36.052.

32.031

## Determination

Transfer 100 mL aliquot prep sample soln to 250 mL beaker and adjust to pH 3.5 with 10% KOH soln added dropwise, using pH meter and mag. stirrer. Pass sample soln thru resin column (column is in chloride form), collecting effluent in 400 mL beaker at flow rate of 2–3 mL/min. Wash column with two 50 mL portions  $H_2O$ , passing first portion at same rate as sample soln and second at 6–7 mL/min. Finally pass enough  $H_2O$  freely thru column to make 250–300 mL final vol. Adjust to pH 12.5–13.0, using pH meter and mag. stirrer, with KOH-KCN soln, 1.022(b). Add 0.100 g ascorbic acid and 200–300 mg hydroxyanthraquinol blue indicator. Titrimetrically with 0.01M EDTA soln thru pink to deep blue end point, using mag. stirrer.

% Ca = mL EDTA × (molarity EDTA soln/0.01)

× 0.4008 × 2 × 100/mg sample

Refs.: JAOAC 49, 287 (1966); 50, 787 (1967); 51, 796 (1968); 53, 730 (1970).

CAS-7448-30-2 (calcium)

## Sodium Chloride in Canned Vegetables

## Final Action

32.032

## \* Method I \*

Proceed as in 3.070 or 3.072, using  $HNO_3$  soln of ach. 3.069. Calc. and report results as % NaCl.

32.033

## \* Method II (Rapid Method) \*

Weigh ca 5 g material, transfer with 98% alcohol to 100 mL vol. flask, and add enough 80% alcohol to give vol. of ca 50 mL. Shake well to suspend all insol. material. Add 1 mL  $HNO_3$  and with pipet add excess of 0.1N  $AgNO_3$  soln. Dil. to 100 mL with alcohol. Transfer mixt. to centr. bottle and centr. 5 min at ca 1800 rpm. Pipet 50 mL supernate into 300 mL erlenmeyer, add 2 mL satd  $FeNH_4(SO_4)_2$  soln and 2 mL  $HNO_3$ , and titr. to permanent light brown with 0.1N  $NH_4SCN$ .

% NaCl = [(mL 0.1N  $AgNO_3$ /2) - mL 0.1N  $NH_4SCN$ ]

× 0.5844 × 100/50 × W

where W = g sample.

Refs.: JAOAC 23, 765 (1939); 23, 353 (1940); 24, 424 (1941); 25, 456 (1942).

## Method III (Potentiometric Method)

32.034

## Principle

Product is dispersed with  $H_2O$  and acidified; sol. chlorides are (titer) potentiometrically with  $AgNO_3$ . Applicable to levels  $\geq 0.03\%$  NaCl. For convenience in calcn. wt or vol. and normality are specified so that 1 mL  $AgNO_3$  = 0.1% NaCl. If balance permitting rapid weighing of specified wt is not available, convenient wt sample and normality  $AgNO_3$  soln may be used.

32.035

## Apparatus

(a) *Balance*.—Capacity,  $\geq 200$  g, taring range,  $\geq 100$  g, readability,  $\leq 0.01$  g. Model No. P1200 (superseded by P1210) (Mettler Instrument Corp., PO Box 100, Princeton, NJ 08540), or equiv., is convenient.

(b) *Electrodes*.—Ag billet combination electrode (Beckman No. 39261, or equiv.), or sep. indicating Ag (Beckman 39604, Orion 94-17, Fisher 13-639-122, or equiv.), and glass ref. (Beckman 40435, Orion 90-02, Fisher 9-313-216, or equiv.) electrodes. Before initial use and before each day's use, if necessary, clean Ag billet electrode (ip with scouring powder or other suitable material and rinse thoroughly with  $H_2O$ . (Hot  $H_2O$  may be required with some kinds of samples.) Clean other electrodes as recommended by manufacturer. Reclean as frequently as necessary to prevent drifting of end point reading. With some samples, periodically rinse electrodes with  $H_2O$  and wipe with tissue to prevent accumulation of film. It is unnecessary to coat Ag billet electrodes with  $AgCl$ .

(c) *Magnetic stirrer*.—Operating thru variable transformer to permit range of speed which, once set, is const.

(d) *pH meter*.—Preferably direct reading, with scale divisions 10 mv or less; range at least  $\geq 700$  mv, e.g., digital type.

32.036

## Reagents

(a) *Nitric acid, dilute*.—(1 + 49). Dil. 20 mL  $HNO_3$  to 1 L with  $H_2O$ .

(b) *Silver nitrate std soln*.—0.0856M. Dissolve 14.541 g  $AgNO_3$  in  $H_2O$  and dil. to 1 L in vol. flask. Store as in 32.037, and adjust to exact normality specified so that with indicated sample wt, 1 mL = 0.1% NaCl. Store in Pyrex container out of direct sunlight. Soln is stable in room light.

\* Staphex method—see inside front cover.

## AOAC OFFICIAL METHODS OF ANALYSIS (1984)

## SUGARS AND SIRUPS 575

sucrose, permitting error to 0.0002% or 0.25%, resp. Adjust instrument to read  $n$  of 1.3330 or 0.9% sucrose with  $H_2O$  at  $20^\circ$ .

Det. refractometer reading of soln at  $20^\circ$  and obtain corresponding % dry substance from either direct reading,  $N$  sugar refractometer is used, or from 52.012, if instrument gives readings in terms of refractive index. Circulate  $H_2O$  at const temp., preferably  $20^\circ$ , thru jacket of refractometer or thru trough of immersion instrument, long enough to let temp. of prisms and of sample reach equilibrium, continuing circulation during observations and taking care that temp. is held const.

If det. is made at temp. other than  $20^\circ$ , or if humidity causes condensation of moisture on exposed faces of prisms, make measurements at room temp. and correct readings to std temp. of  $20^\circ$  from 52.016. If soln is too dark to be read in instrument, dil. with concd sugar soln; never use  $H_2O$  for this purpose. Mix weighed amts of soln under examination and soln of pure sugar of about same strength, and calc. % dry substance in former =  $[(W + B)/C] - 0.016W$ , where  $W$  = wt (g) sample mixed with  $B$ ;  $B$  = wt (g) sugar soln used in diln;  $C$  = % dry substance in mixt.  $W + B$  obtained from refractive index; and  $D$  = % dry substance in pure sugar soln obtained from its refractive index.

For liq. products const invert sugar, correct % solids obtained from 52.017 by adding 0.022 for each % invert sugar in sample.

Refs.: JAQAC 15, 79(1932); 16, 81(1933); 17, 74(1934); 41, 62(1958).

## Ash of Sugars and Sirups

## Final Action

31.012

## Method I

Heat sample of appropriate wt for product being examined (usually 5–10 g) in 50–100 mL Pt dish at  $100^\circ$  until  $H_2O$  is expelled; add few drops pure olive oil and heat slowly over flame or under IR lamp until swelling stops. Place dish in furnace at ca  $525^\circ$  and leave until white ash is obtained. Moisture ash with  $H_2O$ , dry on steam bath and then on hot plate, and re-ash at  $525^\circ$  to const wt.

31.013

## Method II

Carbonize sample of appropriate wt for product being examined (usually 3–10 g) in 50–100 mL Pt dish at ca  $525^\circ$  and treat charred mass with hot  $H_2O$  to dissolve sol. salts. (In case of low-purity products, addn of few drops pure olive oil, as in 31.012, may be desirable.) Filter thru ashless paper, ignite paper and residue to white ash, add filtrate of sol. salts, evap. to dryness, and ignite at ca  $525^\circ$  to const wt.

31.014

## Sulfated Ash

Weigh 3 g sample into 50–100 mL Pt dish, add 5 mL 10% (by wt)  $H_2SO_4$ , heat on hot plate until sample is well carbonized, and then ash in furnace at ca  $550^\circ$ . Cool, add 2–3 mL 10%  $H_2SO_4$ , evap. on steam bath, dry on hot plate, and again ignite at  $550^\circ$  to const wt. Express result as % sulfated ash.

31.015

## Soluble and Insoluble Ash

Ash sample as in 31.012 or 31.013. Add 10 mL  $H_2O$  to ash in the dish, heat nearly to boiling, filter thru ashless paper, and wash with hot  $H_2O$  until combined filtrate and washings measure ca 60 mL. Return paper and contents to Pt dish, ignite carefully, cool, and weigh. Calc. %  $H_2O$ -sol. and  $H_2O$ -insol. ash.

31.016

## Alkalinity of Soluble Ash

Cool filtrate from 31.015 and titr. with 0.1N HCl, 50.81–50.012, using Me orange. 6.005(g). Express alk in terms of mL 1N acid/100 g sample.

31.017

## Alkalinity of Insoluble Ash

Add excess 0.1N HCl (usually 10–15 mL) to ignited insol. ash in Pt dish, 31.015, heat to incipient boiling on hot plate, and cool. Transfer quant. to volumetric flask and titr. excess HCl with 0.1N NaOH, using Me orange. Express alk in terms of mL 1N acid/100 g sample.

31.018

## Mineral Additives in Ash—First Action

In large porcelain evap. dish, mix 100 g sample with ca 35 g  $H_2SO_4$  and evap. to sirupy consistency. Past elec. current thru it while stirring by placing one Pt electrode in bottom of dish near one side and attaching other to lower end of glass rod with which contents are stirred. Begin with current of ca 1 amp and gradually increase to 4. In 10–15 min mass is reduced to fine, dry char that may be readily burned to white ash in original dish over free flame or in furnace.

Note: This method is preferred to ordinary method of heating with  $H_2SO_4$ , especially in case of molasses, because, if properly manipulated, material comes quickly into form of very finely divided char or powder that is especially adapted for subsequent quick ignition.

If elec. current is not available, treat 100 g sample in large porcelain dish, evap. to sirupy consistency with enough  $H_2SO_4$  to carbonize mass thoroly, and ignite in usual manner.

Following adulterants may be present: salts of Sn, used in molasses to bleach; mineral pigments, such as  $PbCrO_4$ , in yellow confectionery; oxides of Fe, sometimes used to simulate color of chocolate; and Cu. These elements may be detected by usual qual. tests.

Refs.: Leach, 32nd Ann. Rept. Mass. Board Health, 1900, p. 163. Leach-Winton, "Food Inspection and Analysis," 4th ed., 1920, p. 654.

## Nitrogen in Sugars and Sirups

## Kjeldahl Method

## Final Action

31.019

## Determination

Det. N in 5 g sample as in 2.857, using larger vol. of the  $H_2SO_4$ , if necessary for complete digestion.

## Sucrose in Sugars and Sirups

## Polarimetric Methods

31.020

## General Procedure—Final Action

(Rules of International Commission for Uniform Methods of Sugar Analysis (ICUMSA))

(a) *Standardization of saccharimeter scale*.—Saccharimeter scale must be graduated in conformity with International Sugar Scale adopted by ICUMSA. Rotations on this scale are designated as degrees sugar ( $^\circ$ ).

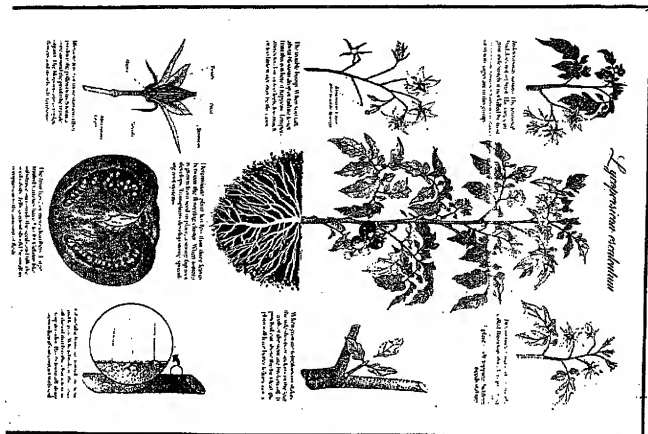
Basis of calibration of  $100^\circ$  point on International Sugar Scale is polarization of normal soln of pure sucrose (26.000 g/100 mL) at  $20^\circ$  in 200 mm tube, using white light and dichromatic filter defined by Commission, (b). Tils soln, polarized at  $20^\circ$ , must give saccharimeter reading of exactly  $100^\circ$ . Temp. of sugar soln during polarization must be kept constant at  $20^\circ$ .

Following rotations hold for normal quartz plate of International Sugar Scale: Normal Quartz Plate =  $100^\circ$  =  $40.680^\circ$  =  $0.602^\circ$  ( $\lambda$  =  $5461 \text{ \AA}$ ) at  $20^\circ$

$$1^\circ (\lambda = 5461 \text{ \AA}) = 2.4576^\circ$$

Normal Quartz Plate =  $180^\circ$  =  $34.631^\circ$  =  $0.002^\circ$  ( $\lambda$  =  $5892.5 \text{ \AA}$ ) at  $20^\circ$

$$1^\circ (\lambda = 5892.5 \text{ \AA}) = 2.8865^\circ$$



# TOMATO PRODUCTION, PROCESSING & TECHNOLOGY Third Edition

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Variety: Hybrid 960N

Protophysics  
Antidary of the Tomato  
Taken from Ortho Chemical Co

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316

## TOMATO TECHNOLOGY

Suggested procedure when using the Abbe Refractometer:

1. After standardizing the refractometer with distilled water (refractive index of 1.330), place a few drops of the serum on the exactly cleaned etched fixed prism of the refractometer and slowly bring the two prisms together and clamp them shut.
2. Turn on the light switch and adjust the light arm for proper illumination.
3. Bring the borderlines into view with the coarse adjustment. (The color of the borderline may have to be compensated by adjusting the compensation dial so that the borderlines is faintly red on each side.)
4. Observe the crosshairs sharply by focusing the eyepiece if necessary and bringing the borderline up to the intersection by means of the coarse or fine hand control.
5. Read the index by depressing the momentary contact switch to the fourth decimal place.
6. Open the prisms and clean very carefully with distilled water and a piece of lens paper. Do not scratch the prisms. When not in use, keep lens paper between the prisms and keep them closed.

When working with tomato materials with a high concentration of insoluble solids, such as pulp and paste, it is advisable to filter out the insoluble solids from the serum (soluble solids). Removal of the insoluble solids does not affect the reading as the refractive index is only going to measure the soluble solids. If the product is difficult to filter, use Klarna (Walaenstein Co.) or Pectinol B (Rehm and Haas Co.) as a filter aid. Either of these materials can be mixed with the tomato materials and filtering is made much easier. Use only a 1% of the filter aid and correct the refractive index reading accordingly.



FIGURE 183. HAND REFRACTOMETER

Courtesy of Lacta Inc.

## TOMATO SOLIDS

317

### WATER INSOLUBLE SOLIDS

Another portion of the total solids content of the tomato that is as important as the Brix value, is the water insoluble solids content. This measurement is the difference between the Total Solids content and the Brix value. This water insoluble portion contains the pectoprotein substances. This value has been used to calculate the Total Solids/Water Insoluble Solids ratio and has been used to predict consistency and or Brix values of the concentrated products. Most workers today do not use this value as it does not tell the whole story.

### ALCOHOL INSOLUBLE SOLIDS

Another aspect of the tomato total solids is the often overlooked alcohol insoluble content. This fraction contains the pectic substances and

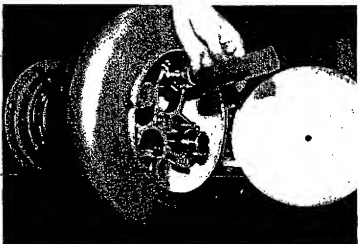


FIGURE 184. CENTRIFUGE FOR DETERMINING PRECIPITATE TOMATO SOLIDS.